Internal and External Imagery Perspective Measurement and Use in Imagining Open and Closed Sports Skills: An Exploratory Study

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Summary. - This study explored the measurement and use of internal and external imagery perspectives during imagery of open and closed sports skills. Participants (n=41; male = 23; female = 18), ages 14 to 28 (M = 19.4 years; SD = 3.12), who were recruited from undergraduate classes in human movement and physical education, and local sporting teams, completed the Imagery Use Questionnaire (IUQ; Hall, Rodgers, & Barr, 1990) and then imagined performing eight common sports skills, four open skills and four closed skills, in a random order. Participants provided concurrent verbalisation (CV) during their imagery. Immediately after imagining each skill, participants completed a rating scale (RS) and retrospective verbalisation (RV) of imagery perspective use. Results indicated that the IUQ gave a general imagery perspective preference, but was not a strong predictor of imagery used on specific occasions. The CV, RS, and RV were equivalent measures of imagery perspective used to imagine performing particular skills. Participants experienced more internal imagery than external imagery while imagining the eight sports skills, but there was no significant difference between perspective use on the open and closed skills.

Imagery is a process where an individual recalls or creates sensory experiences in the absence of external stimuli usually associated with these experiences (Murphy, 1994). Research has shown that imagery is an effective performance enhancement tool and is one of the psychological skills that sports psychologists and athletes use most (Murphy & Martin, 2002; Morris, Spittle, & Perry, 2004; Morris, Spittle, & Watt, 2005). One variable that may affect the effective use of imagery is the imagery perspective the individual adopts (Morris, *et al.*, 2005). Mahoney and Avener (1977) defined perspective in terms of whether the image is internal or external. They proposed that external imagery occurs when the person views themselves from the perspective of an external observer, much like watching oneself on TV. Internal imagery involves the person imagining being inside their body and experiencing those sensations that might occur while performing in the real situation. If imagery perspective affects the effective use of imagery, then investigating the use of imagery perspectives is imperative to understanding how to use imagery effectively (Morris, *et al.*, 2005). To examine imagery perspective, it is important that imagery perspective use be measured appropriately. This study examined the crucial issues of measurement of imagery perspective preferences and imagery perspective use. In addition, because the type of skill or task being imagined might affect imagery use, the influence of task type on imagery use was considered.

Measurement of Imagery Perspective Use

The development of appropriate measures of imagery perspective has been limited, consequently the measurement of imagery perspective use has been problematic, with many studies simply assigning participants to perspective training groups and assuming that they used the assigned perspective, or assigning participants to groups based on self-reported preferences.

There have been two main types of measure of imagery perspective use (Morris, *et al.*, 2005). First, preference or trait measures ask a person to make an overall or global assessment of their usual perspective use, with the person not oriented towards a specific previous event. Trait measures use words like “usually”, “generally”, or “typically”, because they are not focusing on specific events requiring temporal orientation or limitation, e.g., the Imagery Use Questionnaire (IUQ; Hall, Rodgers, & Barr, 1990). Second, imagery perspective use has been assessed by presenting a scene to imagine and, following imagery, asking people to rate their imagery of that scene on a scale, e.g., the Movement Imagery Questionnaire (MIQ; Hall, & Pongrac, 1983) and the Vividness of Movement Imagery Questionnaire (VMIQ; Isaac, Marks, & Russell, 1986). These reports are retrospective in the sense that they ask people to recall a specific event, which requires a temporal orientation. Retrospective reports are subject to memory lapses as well as spontaneous reconstruction of events or processes based on known outcomes (Anderson, 1981; Brewer, Van Raalte, Linder, & Van Raalte, 1991). Thus, a concurrent technique may provide a viable option for measuring imagery perspective use during imagery by providing an account of cognitive processing at the time it occurs, rather than retrospectively (Morris, *et al.*, 2005). Concurrent Verbalisation (CV) is a process where an individual verbalises their cognitive processes while performing the task. It is “thinking aloud” (Ericsson & Simon, 1980). CV has been used successfully in the study of mental processes, such as problem-solving (e.g., Newell & Simon, 1972), visual and verbal coding (e.g., Schuck & Leahy, 1966), cue-probability learning (e.g., Brehmer, 1974), concept learning (e.g., Bower & King, 1967), mental multiplication (e.g., Dansereau & Gregg, 1966), performance on intelligence tests (e.g., Merz, 1969), concentration during running (Schomer, 1986), and expertise in

chess (DeGroot, 1965). Studies on imaginal activity in non sport situations have used the CV technique (e.g., Bertini, Lewis, & Witkin, 1969; Kazdin, 1975, 1976, 1979; Klinger, 1978; Klos & Singer, 1981; Petre & Blackwell, 1999). In a study of non sport motor skills, Annett (1986) investigated imagery of everyday skills, such as knot tying and forward rolls, with CV. Verbalisation can also be used retrospectively to understand cognitive processes. Studies that have used a retrospective verbalisation (RV) protocol include studies on concept learning (Hendrix, 1947; Phelan, 1965), learned generalisations (Sowder, 1974), concept formation (Rommetveit, 1960, 1965; Rommetveit & Kvale, 1965a, 1965b), and expert-novice differences in tennis (McPherson, 2000). Despite their potential to provide rich information on the content of imagery, neither CV nor RV has been used to explore imagery perspective use.

Imagery Perspective Use

Most research on imagery perspectives has focused on the influence of perspective on an outcome variable, such as performance, rather than focusing on which perspective participants use. Questionnaire studies provide some insight into imagery perspective use. In the questionnaire research on imagery perspectives, researchers have typically employed a “trait” approach (Morris, *et al.*, 2005). The findings have been mixed, with some studies finding that elite or more successful performers used more internal imagery than less elite/successful athletes (e.g., Mahoney & Avener, 1977; Doyle & Landers, 1980; Carpinter & Cratty, 1983; Barr & Hall, 1992), some studies finding no difference between these categories of performer (e.g., Highlen & Bennett, 1979; Meyers, Cooke, Cullen, & Liles, 1979; Rotella, Gansneder, Ojala, & Billing, 1980; Hall, *et al.*, 1990), or that elite athletes used more external imagery (e.g., Ungerleider & Golding, 1991). Studies that have

examined performance change due to imagery practice in different perspectives have also produced mixed findings on which perspective leads to superior performance (e.g., Neisser, 1976; Epstein, 1980; Mumford & Hall, 1985;Gordon, Weinberg, & Jackson, 1994). Some researchers have reported that the performance of different types of tasks was affected differently by the perspectives, with external imagery producing greater gains on one task and internal imagery on another (e.g., White & Hardy, 1995; Glisky, Williams, & Kihlstrom, 1996; Hardy & Callow, 1999), but these have not investigated perspective use.

Individual preference for one perspective or another may influence perspective use (Hall, 1997), but no studies have specifically examined this aspect (Morris, *et al.*, 2005). Thus, studies that compare "trait" preference and "state" measures of imagery perspective use may help to clarify if individuals really do have a perspective preference. In a tentative theoretical paper, Morris and Spittle (2001) speculated that internal imagery might be the "default" perspective and that individuals learn the external perspective in sports with experience of perceiving themselves perform, for example, on film or video, or in mirrors. This is consistent with infants' egocentric view of the world that is discussed in the child development literature (Piaget, 1959). In the child development literature, perspective-taking refers to imagining what is experienced from a position other than that of the subject or from a different vantage point (Rigal, 1996). Research on perspective-taking in children suggests that the ability to take on the observer's perspective occurs as the child develops cognitively. Perspective-taking is a skill that we are not born with, but develop (Epley, Morewedge & Keysarb 2004). In imagery rehearsal in sports, internal imagery may be more inherent, but external imagery might add something new and different to the experience. This relates closely to the explanation suggested

by Hardy (1997) that the beneficial effect of imagery practice on motor skills depends on the extent to which the imagery adds to the useful information that is otherwise available.

Skill Type and Imagery Perspective Use

Several psychologists (Harris, 1986; McLean & Richardson, 1994; Annett, 1995) have suggested that closed skills might benefit more from internal imagery, whereas open skills might benefit most from external imagery. Open skills are those where the performance occurs in a constantly changing environment that requires athletes to react to the changing task demands. Closed skills are those skills where the environment is relatively constant and the activity is often self-paced, e.g., gymnastics, darts, diving, or shooting. Until now, researchers have not conducted systematic research based on this classification of skills (Morris, *et al.*, 2005). Other psychologists have suggested that different elements of the task, such as form elements (White & Hardy, 1995; Hardy & Callow, 1999) or spatial elements (Paivio, 1985), might influence which perspective is more efficacious for imagery practice. Consequently, it appears likely that the type of task, as well as imagery perspective preference, might influence the imagery perspective that is most effective and perhaps which perspective participants will use in imagery.

In motor learning and sports psychology, researchers have suggested that the imagery perspective used is an important mediator in the relationship between imagery and learning or performance (Mahoney & Avener, 1977; Morris, et al., 2005). Despite this, there is limited development of appropriate measures of perspective use, and, as a consequence, limited understanding of the use of imagery perspectives in relation to sports skills. For that reason, this exploratory study had two major aims. The first aim was to examine measurement of internal and external

imagery use, so the state measurement methods of CV, RV, and RS and the trait measurement method of the IUQ were used and compared. This comparison allowed an examination of the relationship between a person's general tendency to use internal or external imagery and their use of internal and external imagery for specific tasks. It was hypothesized that there would be a strong relationship between the imagery measures of IUQ, CV, RV, and RS. The second major aim was to examine patterns of internal and external imagery perspective use during imagery of a variety of sports skills. A range of open and closed skills were compared, based on the proposition that the type of task, open or closed, might affect imagery perspective use (e.g., Harris & Robinson, 1986; McLean & Richardson, 1994). Based on this, it was hypothesized that more internal imagery than external imagery would be experienced during imagery of the open skills and that more external imagery than internal imagery would be experienced during imagery of the closed skills.

Method

Participants

This exploratory study involved 23 male participants and 18 female participants with sporting experience, aged between 14 and 28, with a mean age of 19.4 years (*SD* = 3.12). Participants were recruited from undergraduate classes in human movement and physical education, and local sporting teams. Participants reported their primary sporting activity. Eleven participants reported they played cricket, six played netball, five played basketball, three played Australian Rules Football, three were rowers, two were swimmers, and two were triathletes. There was one participant in each of the following activities: calisthenics, surfing, baseball, judo, soccer, running, recreation, 400 m running, and Australian Football League (AFL) umpiring. On the Imagery Use Questionnaire (IUQ; Hall, *et al.*, 1990),

participants rated themselves as either novice (n = 4), intermediate (n = 16), advanced (n = 16), or elite (n = 5) in their primary sporting activity.

Measures

Imagery Use Questionnaire (IUQ; Hall, Rodgers, & Barr, 1990 - Preference for imagery perspective use was assessed by self-report using this questionnaire. The IUQ consists of 35 7-point ordered response scale items ranging from 1 = *never* or *very difficult* to 7 = *always* or *very easy*. There are two yes/no responses. The imagery perspective questions are questions 4a “When you use mental imagery, do you see yourself from outside of your body as if you are watching yourself on a video?” and 5a “When you use mental imagery do you see what you would see as if you were actually playing or performing?”. The IUQ test-retest reliability values were reported to range from r = .65 to r = .95 (Hall, 1998), suggesting acceptable reliability for the IUQ.

Concurrent Verbalisation (CV) - This describes the process where individuals verbalise the information they are attending to and their conscious cognitive processes at the time when they are consciously attending to a process. Essentially, it is thinking aloud. CV was used to examine the use of perspective during imagery of the open and closed skills. Instructions for CV, given before imagery, emphasised describing everything experienced while performing the imagery, with special emphasis on reporting whether the participants experienced the imagery from inside or outside the body. The CV was recorded on audiotape and transcribed later.

Two independent raters scored the transcripts from CV for percentage of internal and external imagery. The raters used expressions indicating internal or external imagery, such as “external” and “internal”, or “inside my body” and “outside my body”, to identify when the imagery was being experienced internally or

externally. Ratings were tested for inter-rater reliability for 13 randomly selected participants, giving 208 trials for comparison. A Pearson product-moment correlation co-efficient between estimated proportion of internal and external imagery used in the trials by the two raters was $r = .999$.

Rating Scale (RS) - This was designed to assess aspects of perspective use during imagery. It was used to probe the relative time spent using internal and external perspectives during the imagery trials, using a 10 cm analogue scale, anchored at each end by *100% internal / 0% external* and the other end by *100% external / 0% internal*. Participants indicated their use of internal and external imagery by placing a cross at the appropriate point on the line.

Retrospective Verbalisation (RV) - This involved a similar process to CV, except that the verbalisation of imagery experience occurred a short time after imagery. It was recorded on audiotape and later transcribed. The raters scored the transcripts for RV, as for CV as described earlier.

Debriefing Questions - At the conclusion of their involvement in the study, participants were asked a series of questions concerning their experience of imagery of the sports skills and the procedure of the study.

Imagery Task

Participants were required to imagine performing eight sports skills. Four of these skills were classified as open skills and four were classified as closed skills. Instructions for imagery of these skills emphasised creating as realistic an imagery experience as possible, describing the use of different sense modalities and the experience of emotions. Instructions were not provided that would encourage the use of either imagery perspective. The imagery was relatively self-paced, in that, following instruction on imagery content, participants could begin imaging whenever

they felt ready. The open skills participants imagined were hitting a tennis ball back over the net, defending against an attack in a team ball game, catching a ball thrown when not knowing to which side it would be thrown, and dodging a ball unexpectedly thrown at the person. The closed skills imagined were hitting a stationary ball with a stick or club, throwing a ball at a stationary target, performing a forward roll on a mat, and rolling a bowl across a bowling green to a jack.

Procedure

Participants were recruited from undergraduate classes in sports psychology and local sporting teams. Participants were provided with plain language statements describing the aims of the study, what was required of them, that their participation in the study was completely voluntary, and that they could withdraw from the study at any time. After providing informed consent, participants completed the IUQ to assess typical use of imagery perspective. The IUQ was administered once prior to the start of all the imagery trials for each participant because it is a typical use measure that is usually administered prior to imagery training in studies (e.g., Rodgers, *et al.*, 1991). Next the protocol for the imagery trials was explained. Participants imagined for two trials on each of four open and four closed skills. The eight skills were presented in a random order and participants completed the two trials on each skill consecutively. During imagery of the skills, CV was recorded. Following imagery of each of the skills, participants completed a RS on imagery perspective use during imagery of that skill and then RV was recorded. Finally, participants answered a series of debriefing questions.

Data Analysis

Pearson product moment correlation co-efficients were calculated among the imagery perspective measures (IUQ, CV, RS, and RV) to determine the similarity of

these measures for assessing perspective use. Then an independent samples t-test was conducted on the IUQ imagery perspective items to assess general reported imagery perspective use. Descriptive statistics were compared on CV, RS and RV for internal and external imagery use during the imagery of the sports skills to assess actual imagery use on imagery trials and differences between imagery perspective use on the individual sports skills. Finally, analysis of variance was conducted on scores on the CV, RS, and RV to determine any differences between perspective use for all the open skills compared to all the closed skills.

Results

Measurement of Imagery Perspective Use

Relationships between measurement techniques. Table 1 indicates very close correspondence between the measures, especially between the CV, RV, and RS data. The correlations between the IUQ perspective items and the CV, RV, and RS data were moderate and in the appropriate direction, with the external item (4a) showing a positive correlation and the internal item (5a) showing a negative correlation. Only the correlation between IUQ 4a and the RV and IUQ 4a and the RS failed to reach significance at $p = .05$. The correlations between the CV, RV, and RS were all above .9, indicating a large effect size and a very high level of agreement between the three state measurement techniques.

Debriefing Questions. Participants reported that they were able to produce imagery of the sports skills without much difficulty. In addition, it seemed that the CV did not provide much interference with the imagery task. The only comments consistently made were that CV seemed to slightly slow down the imagery process, but that it did not change how participants imaged. The reasons given for the slowing of imagery were that it took longer to describe their experience in words than it did

to generate the images, or that it was difficult to find the words to describe the images adequately. Also, many participants made the comment that the descriptions they gave in CV and RV were adequate in describing what had happened, but they were unable to describe many details that were not key elements of the imagery.

Imagery Perspective Use

Imagery Use Questionnaire. The mean for internal imagery use (question 5a, $M = 5.05$, $SD = 1.34$) was higher than that for use of external imagery (question 4a, $M = 3.83$, $SD = 2.02$), indicating greater reported use of internal than external imagery. The scores were normally distributed. An independent samples t-test test indicated a significant effect for item 4a compared with item 5a ($t_{40} = -2.8$, $p<.01$, $\eta^2 = .08$), with the mean for the internal imagery item greater than that for the external imagery item and a medium to large effect size.

Concurrent Verbalisation (CV), Retrospective Verbalisation (RV), and Rating Scale (RS) Data. Scores from CV, RV, and RS, averaged for the two trials for each skill are summarised in Table 2. The scores for the RS are also presented in Figure 1 to highlight the variation between scores on individual skills. Possible scores range from 0 to 100, with a low score indicating more internal imagery and a high score indicating more external imagery. Results indicated that, for every skill, participants experienced more internal imagery than external imagery. The sports skills with the lowest scores, indicating the most internal imagery content, were hitting a tennis ball back over the net and catching a ball thrown at you when not knowing to which side it would be thrown. The sports skill with the highest mean, indicating a relatively larger amount of external imagery content, was dodging a ball thrown at the person unexpectedly. Also of note are the relatively high standard deviations for all skills. This indicates variability between the responses of different participants for the same

skill, probably due to participants reporting either high internal or high external imagery content, with few rating moderate amounts of internal and external imagery for each skill. The means for the four open and the four closed skills were both below 50, indicating that participants experienced more internal imagery than external imagery in both skill types.

Skill Type and Imagery Perspective Use

Figure 2 displays the means for the open and closed skills classification for the state measurement techniques, CV, RS, and RV. One-way Repeated Measures ANOVA's found no significant differences between the open and closed skills for the CV (Wilks $\Lambda = .97$, $F_{1, 40} = 1.33$, $p > .05$, $\eta^2 = .03$, observed power = .203), for the RS (Wilks $\Lambda = .97$., $F_{1, 40} = 1.10$, $p > .05$, $\eta^2 = .03$, observed power = .176), or for the RV (Wilks $\Lambda = .932$, $F_{1, 40} = 2.91$, $p > .05$, $\eta^2 = .07$, observed power = .384), with very small effect sizes.

Discussion

The perspective adopted during imagery affects the imagery experience and may mediate the relationship between imagery and learning or performance effects (Morris, *et al.*, 2005). The measurement of imagery perspective use in the past has been limited to sporadic use of retrospective approaches, with limited development of appropriate tools. Consequently, in this exploratory study the measurement of internal and external imagery perspective use was investigated with several state and trait measurement approaches to assist in the development of appropriate imagery perspective measures. Perhaps because of the limited development of measures in the past, our understanding of how perspective is used during imagery is also inadequate. To aid in the development of knowledge related to the role of imagery perspectives in imagination of sports skills, patterns of internal and external imagery perspective

use during imagery of a variety of sports skills were also examined. A range of open and closed skills were compared, based on the hypothesis that the type of task, open or closed, might affect imagery perspective use (e.g., Harris & Robinson, 1986; McLean & Richardson, 1994; Morris, *et al.*, 2005).

Measurement of Imagery Perspective Use

A comparison of the imagery perspective measurement techniques indicated that the IUQ provided only a general indication of perspective use. Imagery perspective preference as measured by the trait measure, IUQ, was not strongly associated with imagery perspective used on a particular occasion. The moderate correlations are typical of trait-state associations (e.g., Martens, Burton, Vealey, Bump, & Smith, 1990). The CV, RS, and RV techniques, completed during or immediately after imagery, were all highly correlated with one another and seem to be equivalent measures of perspective experienced during imagery, at least when RS and RV are measured immediately after the imagery. This conclusion is limited somewhat by the fact that the three measures were all administered relatively close together. This might have artificially inflated the level of agreement between the responses.

To measure imagery perspective accurately, the results of this exploratory study suggest that a specific state measure, e.g., CV, RS, or RV, is more appropriate than a general questionnaire. Murphy (1990, 1994) has pointed out that the accurate measurement of critical aspects of imagery is crucial to the effectiveness of imagery training. The checking of imagery content or quality during research and practice has been far from standard, yet it has been found that participants in imagery studies can change or vary the imagery script (e.g., Woolfolk, Murphy, Gottesfeld, & Aitken, 1985; Harris & Robinson, 1986; Jowdy & Harris, 1990). Thus, there has been a

problem with ensuring the success of independent variable manipulation in the imagery literature.

The only researcher who has used a CV technique with imagery of movement skills, not sports specific, however, was Annett (1986). Annett, however, had no reliability checks for CV, whereas the present study compared CV with RS and RV. In applied work, as well as in research, CV may be a useful technique to check whether research participants or athletes are following the treatment protocol during mental training (Morris, *et al.*, 2005). The present study indicated that the CV technique did not interfere greatly with the imagery task, based on the debriefing questions and the fact that participants seemed able to produce imagery of the sports skills easily. The only comment consistently made in the debriefing questions was that the CV seemed to slow the imagery process down a little, because it took longer to describe the imagery experience in words than it did to generate the images, or because participants had trouble finding the words to adequately describe the imagery. Nonetheless, given the very high correlations between CV, RS, and RV, if choosing a state measure, RS would appear to be most suitable when scores for quantitative analysis are needed. RS is also very easy to administer and score. RV is best when researchers want reports of the content of imagery. RV would generally be preferred to CV in this context because RV provides very similar information to CV, but does not interfere with the imagery at all. When the task is complex and long in duration, so memory might not be reliable, CV would seem to be the most appropriate measure.

Imagery Perspective Use

Participants indicated a preference for internal imagery on the IUQ. In imagery of the eight sports skills, participants also reported using more internal imagery than

external imagery. This might suggest that people do have an imagery perspective preference towards internal imagery. This finding is consistent with the idea that imagery perspective is initially internal and the extent to which it becomes external or mixed depends on experience, particularly during childhood, as in a default perspective (Morris & Spittle, 2001; Fogarty & Morris, 2003). This also seems to coincide with the child development literature on perspective-taking, which suggests that the ability to take on the observer's perspective is not something we are born with, but needs to be developed (Epley, *et al.,* 2004; Piaget, 1959; Rigal, 1996). Despite this, participants reported use of external imagery on the IUQ and during imagery trials, so external imagery, although not the default, may add something new and different to the imagery experience (Cox, 2002: Morris, *et al.*, 2004) or add to the useful information that is otherwise available (Hardy, 1997). It might also be that the participants had developed to a stage where they could utilize an external perspective, but tended to rely more on the default.

Clearly, there is a need for more research on whether there is a perspective preference and if this tends to be for internal or external imagery, or is moderated by experience, skill level, and/or imagery training. Investigations into whether training in a given perspective influences subsequent perspective use during imagery are also recommended. Studies on internal and external imagery have generally assigned participants to an internal or external imagery group based on pre-test preferences (e.g., Epstein, 1980; Gordon et al., 1994; White & Hardy, 1995; Glisky et al., 1996), or trained groups in internal imagery (e.g., Templin & Vernacchia, 1995) and pre- and post-tested them on performance without checking actual imagery use during imagery trials. Some of the studies used a manipulation check of perspective use after participants had completed the imagery training using rating scales or

interviews (e.g., Epstein, 1980; White & Hardy, 1995), but due to the delay between actual imagery and retrospectively reporting imagery use, these manipulation checks may be prone to errors in memory.

In the present study, the use of imagery across individual tasks appeared to vary, for instance, the tennis task had a large internal imagery component, whereas the forward roll appeared to have a larger external component than imagery of some other skills. No studies of which the researchers are aware have specifically compared perspective use during imagery of two or more skills without instruction to imagine in a given perspective. The differences between tasks might be due to perceptual elements of the tasks. Seven of the eight sports skills imagined were ball sports activities that would require the analysis of a perceptual target (Paivio 1985), and perhaps an internal perspective is most commonly used for tracking the ball. The one skill that did not involve a ball sport was performing a forward roll and it was the skill with the highest external imagery mean on the CV measure. Perhaps, what is needed is to determine how to use imagery most effectively according to the specific task, rather than to continue studying which categories of task produce superior effects for a given perspective.

Skill Type and Imagery Perspective Use

In the present study, there was no significant difference between imagery perspective use on the open and closed sports skills and the effect sizes were small. This pattern of use does not seem to support the suggestion of several researchers (e.g., Harris, 1986; McLean & Richardson, 1994), who have proposed that learning and performance of closed skills would benefit more from an internal perspective, whereas open skills should benefit from an external perspective. In the current exploratory study, however, imagery use rather than learning or performance was

measured. Interestingly, White and Hardy (1995) and Glisky et al. (1996) expected findings in line with the suggestions of McLean and Richardson, but actually found the opposite effect. That is, White and Hardy and Glisky, *et al.* reported that the internal imagery group produced larger performance improvements on the open skills and the external imagery group produced larger performance improvements on the closed skills.

Methodological Issues

In the present study, a higher use of internal imagery overall was found. The study does not provide information on which perspective is more effective for performance enhancement of these skills. Thus, research is needed to investigate internal and external training effects on performance. In future studies, researchers may also consider using a wider range of open and closed skills, especially comparing ball skills with movement skills, as the present study utilised predominantly ball skills. In addition, the skills used in the present study were short duration and basic skills, with very little descriptive detail, due to the requirement of not influencing perspective use and also to ensure that participants could develop imagery of the skill described. If participants were given more descriptive detail of the event and also the event was made more realistic or of a longer duration, then imagery perspective use patterns may differ. Great care was taken not to influence participants to use either perspective, however, the instruction to experience all the senses might have led to some participants making the interpretation that internal imagery was what the researcher was looking for.

Other methodological issues relate to the choice of sports skills to imagine. Four closed and four open skills were selected as being common skills that would be experienced by most people who played sports. One problem with skill selection

might have been that all of the skills, except one (the forward roll), were ball sport activities. This may have had an effect on the type of imagery experienced. For instance, in the two skills with the highest external scores across the three measures, performing a forward roll and dodging a ball, perhaps the focus was on the person or the movement. This might indicate that the perceptual elements of the task were important determinants of the perspective used in imagery. Maybe the imagery of most of the skills that focus on what the ball does requires a focus from inside the body, whereas those skills that require gross body movement stimulate some sort of external check on how the body is moving. This could be a general characteristic of internal and external perspectives or it could be an artefact of the specific imagery instructions, but it is worth exploring further in future research. Conversely, it could be argued that by having ball sports for both open and closed skills, comparison between these skill categories was more carefully controlled, because the only perceptual or motor difference was the open or closed nature of the task. For example, if the aim is to compare open and closed skills, it seems more appropriate to compare an open ball sport with a closed ball sport than an open ball sport with a closed running sport, where the difference in the demands of the task could confound the variable of interest. A problem also might occur in relation to the extent to which participants can actually imagine open skills. This is because it is difficult for a person to produce images of the unexpected. There is really no environmental unpredictability in imagery, because the person must generate the image. In future research, a degree of unpredictability could be introduced by having people imagine a task like catching a ball or throwing a ball at a target, with different pitch tones as cues to where the ball is coming from or where the target is located.

Imagery is a powerful technique, which is widely used in sports (Morris, *et al.*, 2004). Researchers agree that imagery perspective is often a critical factor in the effectiveness of imagery (Morris et al., 2005). This exploratory study has raised several important points related to imagery perspective use. First, the study showed that trait-like measures, such as the IUQ, are unlikely to accurately predict imagery perspective use on specific occasions. Second, three self-report measures of actual imagery perspective use agreed very closely, suggesting that they are reliable measures. Third, the results indicate that RS is a useful technique for speed and simplicity of measurement of actual imagery perspective use, with accuracy. Finally, the present research suggests that imagery perspective use does not vary between open and closed skills in the same way as researchers have shown imagery perspective to affect the performance of open and closed skills. These findings suggest that researchers need to think again about research designs to study the affect of imagery perspective. Further research is called for, which monitors imagery use, employing RS, or CV or RV, to increase our understanding of the role of imagery perspectives in imagery in sports.

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Table 1

Pearson Product Moment Correlation Co-efficient Comparison of Various Measurement Techniques

	IUQ5a	Concurrent Verbalisation (CV)	Retrospective Verbalisation (RV)	Rating Scale (RS)
IUQ 4 a	-.35*	.33*	.30	.33*
IUQ 5a		-.46**	-.45**	-.52**
Concurrent Verbalisation (CV)			.91***	.94***
Retrospective Verbalisation (RV)				.90***

*p<.05, **p<.01, ***p<.001

Table 2

Summary of Skills by Measurement Technique

	Concurrent Verbalisation (CV)		Rating Scale (RS)		Retrospective Verbalisation (RV)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Tennis	28.84	39.67	31.35	36.90	22.68	41.17
Defending	30.06	35.89	32.49	36.58	31.59	41.52
Catching	32.65	39.21	27.52	31.05	26.61	41.94
Dodging	41.46	41.82	43.48	39.73	45.17	48.34
Open Skills	33.25	29.39	33.71	26.24	33.71	26.23
Throwing	34.89	43.09	37.65	41.19	34.56	45.56
Hitting	34.27	39.92	34.55	37. 49	32.93	41.80
Forward Roll	46.98	45.28	42.52	38.34	46.90	47.53
Bowling	34.37	40.73	31.85	34.66	38.05	45.95
Closed Skills	37.63	32.39	36.64	27.48	36.64	27.48
All Skills	33.61	28.24	35.18	25.33	34.81	28.17

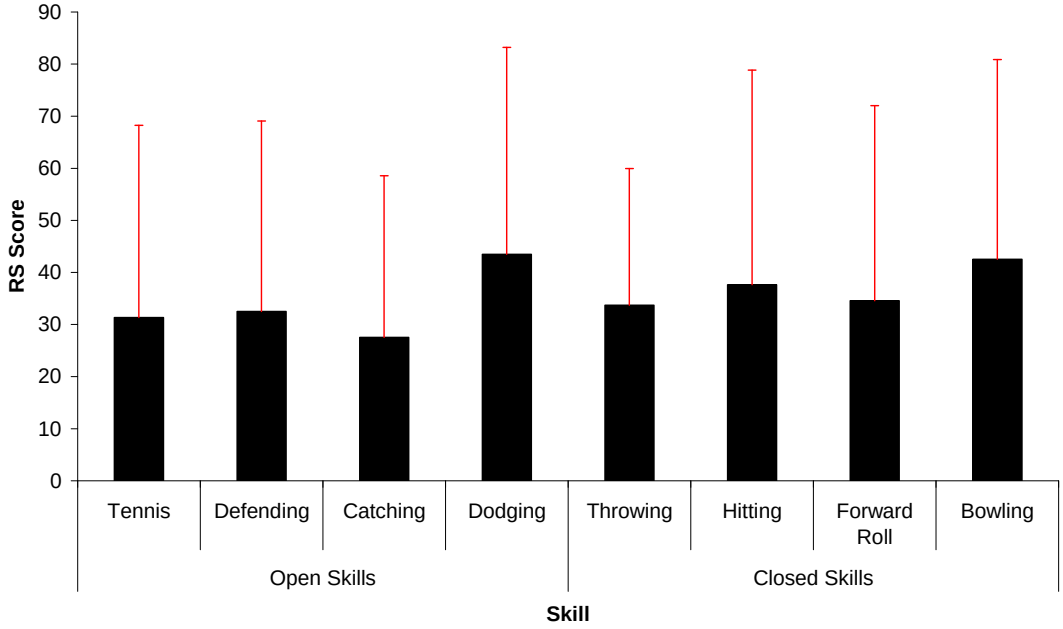

Figure 1. Mean RS Scores for imagination of the sport skills (+SD).

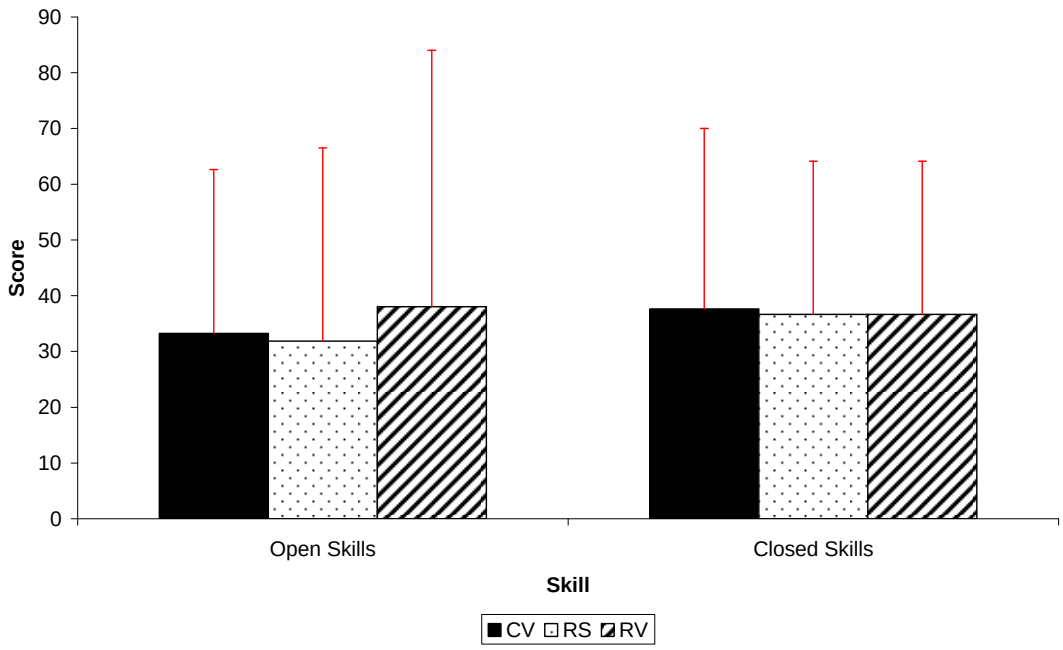

Figure 2. Mean CV, RS, and RV scores for imagination of the open and closed sport skills (+SD).